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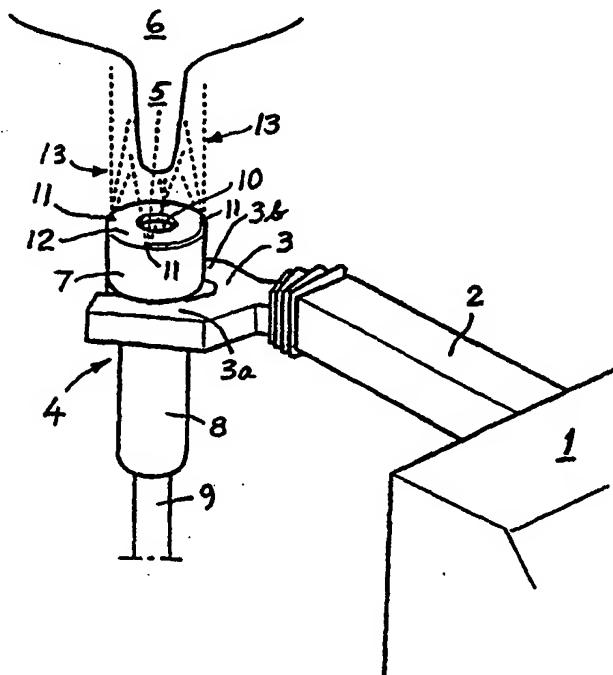
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| (21) International Application Number: PCT/SE99/00427<br>(22) International Filing Date: 18 March 1999 (18.03.99)<br>(30) Priority Data:<br>9800921-0 19 March 1998 (19.03.98) SE<br>(71) Applicant (for all designated States except US): ALFA LAVAL<br>AGRI AB [SE/SE]; P.O. Box 39, S-147 21 Tumba (SE).<br>(72) Inventors; and<br>(75) Inventors/Applicants (for US only): FORSÉN, Gösta [SE/SE];<br>Bernströmsvägen 29, S-146 38 Tullinge (SE). JOHANNES-<br>SON, Leif [SE/SE]; Beställsvägen, S-147 21 Tumba (SE).<br>(74) Agents: BERG, S., A. et al.; Albihs Patentbyrå Stockholm<br>AB, P.O. Box 5581, S-114 85 Stockholm (SE). |  | (81) Designated States: AE, AL, AM, AT, AT (Utility model), AU,<br>AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ<br>(Utility model), DE, DE (Utility model), DK, DK (Utility<br>model), EE, EE (Utility model), ES, FI, FI (Utility model),<br>GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,<br>KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG,<br>MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE,<br>SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA,<br>UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM,<br>KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM,<br>AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT,<br>BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU,<br>MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM,<br>GA, GN, GW, ML, MR, NE, SN, TD, TG).<br>Published<br>With international search report.<br>Before the expiration of the time limit for amending the<br>claims and to be republished in the event of the receipt of<br>amendments. |   |

(54) Title: AN ARRANGEMENT AND A METHOD FOR SPRAYING A DISINFECTANT LIQUID ONTO THE TEATS OF AN ANIMAL

(57) Abstract

An arrangement for spraying a disinfectant liquid on the teats of an animal, comprising teat cups to be connected to the teats of the animal for milking same. On the outside of each teat cup (4) there are arranged spray nozzles (11) for spraying disinfectant liquid (13) onto the teat. Each spray nozzle is adapted to spray disinfectant liquid onto the teat during removal of the teat cup (4) from the teat (5) when the milking is terminated. A method of milking an animal comprises connecting teat cups to the animal's teats; extracting milk; sensing a ceasing milk flow, and in response thereto removing the respective teat cup from its teat; and spraying a disinfectant liquid (13) onto the teat (5) during said removal of the teat cup (4) from said teat.



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**An arrangement and a method for spraying a disinfectant liquid onto the teats of an animal**

Technical field of the invention

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The present invention relates to an arrangement for spraying a disinfectant liquid on the teats of an animal, such as a cow, sheep, goat, horse or a buffalo.

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The invention also relates to a method of milking an animal by connecting teat cups to the teats of the animal, extracting milk from the teats by means of the teat cups, sensing a ceasing milk flow through any teat cup and in response thereto removing such teat cup from its teat.

Background of the invention

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EP-0 535 754 discloses an implement and method, respectively, for after-treating the udder and teats of a milked animal by means of a specific after-treating device having a spray nozzle. However, this spray nozzle is located at the end of a milking robot arm between the two front teat cups and below a carrier plane on which the teat cups rest. The after-treating liquid is sprayed by the spray nozzle in a fan-shaped pattern covering the entire udder.

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Consequently, the greater part of the sprayed liquid ends up as a liquid film on the outside of the udder, whereas only a minor part of the sprayed liquid comes down on the outside of the very teats. Thus, this prior art spraying technique leads to a large disinfectant liquid consumption and does not ensure satisfactory teat disinfection because of inaccurate application of the sprayed liquid onto the teats.

Object of the invention

The primary object of the invention is to be able to spray a disinfectant liquid onto the respective teats of the udder without spraying at the same time the udder itself.

Another object is to minimize the consumption of disinfectant liquid.

Still another object is to be able to perform the spraying action by means of spraying equipment which is brought in the required position for the spraying by means of a device which in any case has to be in that position. When using an automatic milking system comprising a milking robot arm this means that no additional or specific robot arm movement should be needed to bring the spraying equipment in the position required for the spraying.

Summary of the invention

These objects are obtained by an arrangement for spraying disinfectant liquid on animal teats, comprising at least one, i.e. one or more, teat cup to be connected to an animal teat for milking same, each teat cup being provided - on the outside thereof - with at least two spray nozzles adapted to spray disinfectant liquid onto the respective teat which is to be sprayed, wherein the spray nozzles are so positioned in relation to the teat cup, that the jet outlets of the nozzles are situated adjacent to the outer edge of the teat entry end portion of the teat cup where the inlet opening for the teat is located.

Preferably, each spray nozzle is adapted to spray disinfectant liquid onto the teat during removal of the teat cup from the teat when the milking is terminated.

This teat cup removal is the normal detachment from the teat after terminated milking, and may be done by means of e.g. a milking robot arm in an automatic milking system, or by exerting a pull or tractive force on the teat cup by means of a cord

having one end attached to the teat cup and the other end attached to a withdrawal means, such as the displaceable element of a pneumatic or hydraulic cylinder or other actuator. Instead of using a specific cord it is possible to use the milk tube (leading from the teat cup) as "cord".

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According to a first embodiment of the invention, the arrangement may comprise a set of teat cups to be handled semi-automatically or manually for attaching or detaching them to/from the teats before and after milking, respectively. Alternatively, a milking robot arm may be provided for automatically connecting (attaching) each teat cup to a respective teat. Such robot arm may also be used for disconnecting (detaching) the teat cup from the teat.

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In order to obtain a disinfectant liquid film of uniform thickness over the teats, each teat cup is provided with at least a pair of spray nozzles, preferably placed on opposite sides of the teat cup. If three or more spray nozzles are provided they should preferably be uniformly spaced around the teat cup.

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To minimize the risk that the jets of atomized spray liquid from the outlets of the nozzles become deflected or disturbed before reaching the intended "target surface area", i.e. the surface of the teats, the nozzles on each teat cup are so positioned in relation to the teat cup, that the jet outlets of the nozzles are situated near the outer edge of the teat entry end portion of the teat cup where the inlet opening for the teat is located.

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It is probably to be preferred that the spray nozzles are structurally integrated in the circumferential outer edge of an enlarged, cylindrical forward end portion of the teat cup.

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To secure proper function of the spray nozzles in attaining an effective coating of the teat surface with the sprayed disinfectant liquid without undue liquid wastage each spray nozzle preferably provides a fan-shaped spray pattern away from the teat

entry end portion of the teat cup in a direction obliquely towards the centre line of the teat cup.

5 The present invention also relates to a method of milking an animal, as defined in the preamble of claim 9, and characterized by spraying a disinfectant liquid onto the teat during removal of the teat cup from the teat, where the spraying is performed by means of spray nozzles being attached to and carried by each respective teat cup, thereby following the motion of same, and being arranged around the inlet opening of their teat cup. The spraying action may be initiated just before the removal  
10 motion of the teat cup is started, and it may continue until the teat cup has become entirely separated from the teat.

In certain cases it may be preferable or advantageous that the method also comprises the additional steps defined in claims 10-12.

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#### Description of drawings

The invention will now be further elucidated by means of the following description of a preferred embodiment shown in the enclosed drawing, wherein:

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Fig. 1 is a schematic perspective view of a spraying arrangement comprising a teat cup being removed from an animal teat by means of a robot arm; and  
Fig. 2 is a schematic vertical projection of a teat cup connected to a teat.

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#### Detailed description of a preferred embodiment

In Fig. 1 there is schematically shown a milking robot 1 having a protruding robot arm 2 with a movable handling means in the form of a gripper 3 provided at the outer end of the arm. The gripper may be a rigid gripper or fork the arms 3a and 3b of which are not movable towards one another, or a non-rigid gripper the arms of  
30 of which are mutually movable shackles. By means of the gripper and its arms 3a, 3b a

teat cup 4, to be used for milking an animal, can be grasped and moved in relation to a teat 5 of an animal udder 6, e.g. the udder of a cow to be milked.

5 The teat cup 4 comprises an enlarged, cylindrical fore (upper in Fig. 1) end portion 7, and a narrower cylindrical shell or main portion 8 (lower portion in Fig. 1). A milk tube 9 extends from the rear end of the main portion 8. The gripper arms 3a, 3b engages the shell immediately under the enlarged fore end portion 7, thereby supporting the teat cup during the transfer thereof.

10 At the teat entry end of the end portion 7 there is provided a central inlet opening 10 for the teat.

15 In order to simplify the spraying of a disinfectant liquid, e.g. iodic liquid, on the teats of an animal when the milking procedure has been completed, the teat cup 4 is provided, on the outside of the fore end portion 7, with a number of spray nozzles 11, in this case four nozzles. These nozzles are evenly distributed and spaced along the circumferential outer edge of end portion 7.

20 The four spray nozzles are structurally integrated in the outer edge of end portion 7 in order not to make difficult or obstruct the cleaning or washing of the teat cup. The jet outlets of the nozzles 11 are preferably positioned flush with the end surface 12 at the teat entry end of portion 7.

25 As indicated in Fig. 1 each spray nozzle 11 provides an atomized spray jet 13 with a fan-shaped spray pattern away from the teat entry end surface 12, preferably in a direction obliquely towards the centre line of the teat cup, which will correspond to the centre line of the teat from which the teat cup is being removed.

30 In Fig. 2 there is shown a teat cup 4 which is connected to a teat 5. When the teat cup 4 is removed from the teat 5, in this case by applying a tensile force F on a cord 14 attached to the teat cup main portion or shell 8, the nozzles 11 are activated (e.g.

by electronic control means) and used to spray disinfectant liquid onto the teat 5. The spraying may e.g. be initiated when the teat entry end surface 12 of the teat cup 4 has reached position R1 and may continue until the end surface 12 reaches position R2 in relation to the teat 5, during the removal motion. Instead of using cord 14 to execute the removal of the teat cup, it is of course possible to use a robot arm 2 and gripper 3 as shown in Fig. 1, or to use the very milk tube 9 as a "cord" instead of cord 14.

### Operation

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A normal method of milking an animal, e.g. a cow, may include: connecting teat cups to the teats of the animal; extracting milk by means of the teat cups; sensing a ceasing milk flow through one or more of the teat cups; and in response to the detection of such ceasing milk flow removing all or at least the appropriate ones of the teat cups from the teats.

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In order to avoid the need of having to resort to a particular or extra stage (in the milking process) for performing the necessary disinfection of the teats, when the milking has been completed, the present invention makes use of the anyway effected removal of the teat cups when the milking is terminated.

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To this end, according to the present invention, each teat cup is provided with spray nozzles adapted to spray disinfectant liquid onto the teat concerned during the normal removal motion of the teat cup from said teat, when the milking has been terminated. The time of this removal motion can be used as a "spraying period" irrespective of whether the teat cup removal is done by means of the robot arm gripper or by some other means, e.g. by drawing loose the teat cup from its teat by providing a tensile force in a cord attached to the teat cup.

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The characterizing step of the method according to the present invention is spraying a disinfectant liquid onto the teat during the teat cup removal from the teat; and this

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spraying is preferably effected by two, three or four spray nozzles being attached to and carried by each teat cup, thereby following the teat cup during the removal of same.

Claims

1. An arrangement for spraying a disinfectant liquid on the teats of an animal, e.g. a cow, characterized in that the arrangement comprises one or more teat cups (4) to  
5 be connected to the teats of the animal for milking same, each teat cup (4) being provided, on the outside thereof, with at least two spray nozzles (11) for spraying disinfectant liquid (13) onto the teat (5), wherein the spray nozzles (11) are so positioned in relation to the teat cup, that the jet outlets of the nozzles are situated adjacent to the outer edge of the teat entry end portion (7) of the teat cup (4) where the  
10 inlet opening (10) for the teat (5) is located.
2. An arrangement as claimed in claim 1, characterized in that each spray nozzle (11) is adapted to spray disinfectant liquid onto the teat (5) during removal of the teat cup (4) from the teat when the milking is terminated.
- 15 3. An arrangement as claimed in claim 1 or 2, characterized in that the arrangement comprises a set of teat cups to be handled semi-automatically or manually for connecting and disconnecting them to/from the teats before/after milking.
- 20 4. An arrangement as claimed in claim 1 or 2, characterized in that a milking robot arm (2) is provided for automatically connecting each teat cup (4) to a respective teat (5), and possibly also for disconnecting said teat cup from said teat.
5. An arrangement as claimed in any one of claims 1 - 4, characterized in that each  
25 teat cup (4) is provided with two or more spray nozzles (11) spaced around the teat cup.
6. An arrangement as claimed in any one of claims 1-5, characterized in that the spray nozzles (11) are structurally integrated in the circumferential outer edge of an  
30 enlarged, cylindrical forward end portion (7) of the teat cup (4).

7. An arrangement as claimed in any one of claims 1-6, characterized in that each spray nozzle (11) is adapted to provide a fan-shaped spray pattern (13) away from the teat entry end portion (7) of the teat cup (4) in a direction obliquely towards the centre line of the teat cup.

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8. An arrangement as claimed in any one of the preceding claims, characterized in that the disinfectant liquid is iodine or consists of iodine.

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9. A method of milking an animal by connecting teat cups to the teats of the animal, extracting milk from the teats by means of the teat cups, sensing a ceasing milk flow through any teat cup (4) and in response thereto removing such teat cup (4) from its teat, characterized by spraying a disinfectant liquid (13) onto the teat (5) during removal of the teat cup (4) from said teat, where the spraying is performed by means of spray nozzles (11) being attached to and carried by each respective teat cup (4), thereby following the motion of the same, and being arranged around the inlet opening (10) of their teat cup.

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10. A method as claimed in claim 9, characterized in that the removal of the individual teat cup from its teat is effected by applying a tractive force on the cup by a traction force conveying means attached to the teat cup, e.g. a cord or a milk tube extending from the cup.

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11. A method as claimed in claim 10, characterized in that the traction force conveying means is arranged to be drawn to a teat cup rack or to a service arm being movable underneath the animal.

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12. A method as claimed in claim 10, characterized in that the removal of the individual teat cup from its teat is effected directly by means of an animal related robot arm or via a cord connected to such robot arm.

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/00427

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A01J 7/04

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A         | DE 2622794 A1 (ALFA-LAVAL AGRAR GMBH),<br>8 December 1977 (08.12.77)               | 1,2,8,9               |
|           | --   |                       |
| A         | EP 0801893 A2 (MAASLAND N.V.), 22 October 1997<br>(22.10.97)                       | 1,3-7                 |
|           | --   |                       |
| A         | GB 918766 A (E.D. DYKE), 20 February 1963<br>(20.02.63)                            | 1,5,9                 |
|           | --   |                       |
| A         | US 4924809 A (J.K. VERBRUGGE), 15 May 1990<br>(15.05.90)                           | 1-4,8,9               |
|           | --   |                       |

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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|-----------|---|-----------------------|
| A         | US 4838207 A (C.J.G. BOM ET AL), 13 June 1989<br>(13.06.89)<br><br>-----<br><br>----- | 10-12                 |

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

01/06/99

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| Patent document cited in search report |         |    | Publication date | Patent family member(s)   | Publication date   |
|--|---------|----|------------------|---|--|
| DE                                     | 2622794 | A1 | 08/12/77         | NONE  |  |
| EP                                     | 0801893 | A2 | 22/10/97         | NONE  |  |
| GB                                     | 918766  | A  | 20/02/63         | NONE  |  |
| US                                     | 4924809 | A  | 15/05/90         | AT 81439 T<br>AU 602381 B<br>AU 1020988 A<br>DE 3782238 A<br>DK 50088 A<br>EP 0277396 A,B<br>SE 0277396 T3<br>EP 0527509 A<br>JP 2529875 B<br>JP 2608044 B<br>JP 8037972 A<br>JP 63196216 A<br>NL 8700249 A   | 15/10/92<br>11/10/90<br>04/08/88<br>19/11/92<br>03/08/88<br>10/08/88<br><br>17/02/93<br>04/09/96<br>07/05/97<br>13/02/96<br>15/08/88<br>01/09/88   |
| US                                     | 4838207 | A  | 13/06/89         | AT 81579 T<br>AT 116798 T<br>AT 142417 T<br>DE 3852767 D,T<br>DE 3855542 D,T<br>DE 3856200 D,T<br>DE 3875414 A<br>EP 0300582 A,B<br>SE 0300582 T3<br>EP 0448132 A,B<br>SE 0448132 T3<br>EP 0480541 A,B<br>SE 0480541 T3<br>EP 0545916 A,B<br>EP 0630564 A<br>EP 0630565 A<br>EP 0634096 A<br>EP 0643909 A<br>EP 0714595 A<br>JP 1051030 A<br>JP 2583989 B<br>NL 8701735 A | 15/11/92<br>15/01/95<br>15/09/96<br>13/07/95<br>27/02/97<br>07/01/99<br>26/11/92<br>25/01/89<br><br>25/09/91<br><br>15/04/92<br><br>09/06/93<br>28/12/94<br>28/12/94<br>18/01/95<br>22/03/95<br>05/06/96<br>27/02/89<br>19/02/97<br>16/02/89 |